The Impact of Tornadoes on Local Economies

Dennis Weaver (Central Michigan University)
Mentored by: Kim Klockow, Harold Brooks, Alan Gerard
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Abstract

This study utilizes county level sales tax data to investigate the economic impact of tornado activity on local communities in the states of Tennessee (1999-2019) and Oklahoma (2004-2019). After accounting for large scale economic trends and various local variables, a fixed effects model is developed. The resulting model shows intense (EF4+) tornadoes and tornadoes affecting largely populated areas cause significant economic changes. While statistically significant events in both states show a wide range of impacts, Tennessee tornadoes were found to have more extreme effects. A set of models capable of predicting economic activity following a tornado event would be useful for understanding the geographic regions most prone to economic change and aid in post-disaster relief efforts.

Introduction

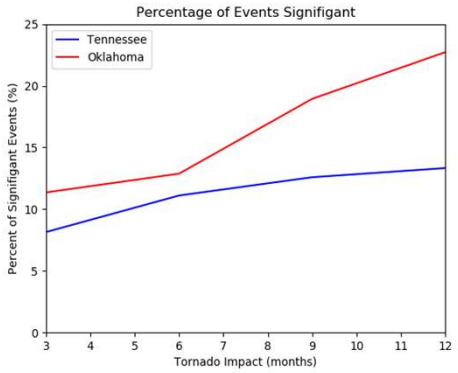
- Comparing localized economic impact of strong (EF2+) tornadoes in Tennessee (1999-2019) and Oklahoma (2004-2019)
- Wide variety of potential impacts:
  - Positive: recovery spending/rebuilding, new investment, external grant support
  - Negative: loss of jobs/income, loss/disruption of businesses
- Previous research focused on hurricanes showed up to 5% decrease in employment

Methodology

- Model includes:
  - National economic activity (GDP)
  - County-level population, employment, income
  - Seasonality
  - Recessions
  - Tornadoes
- Tornado effects examined over 3, 6, 9, and 12 month time intervals
- For multiple tornadoes in same county, we capture average effect

Results

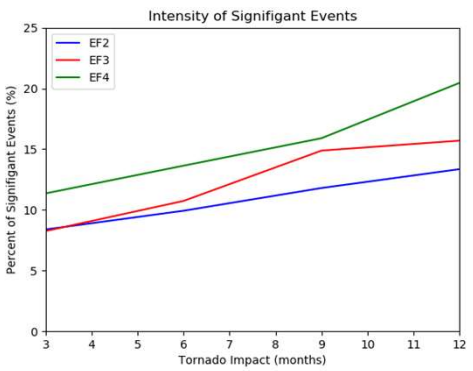
Significant Events as Percentage of Total



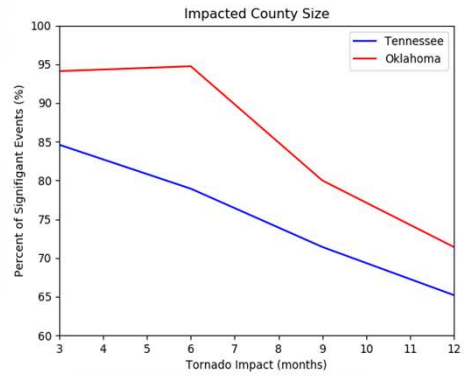
Model Results (6 months)

Independent Variables	Tennessee (1999-2019)	Oklahoma (2004-2019)
Constant	-2.416E+06 (1.92E+05)	5.136E+05 (5.99E+04)
GDP	1.339E+04 (864.254)	-1612.866E+06 (258.408)
Population	-51.542 (1.003)	-2.102 (0.323)
Income	1.272 (0.018)	0.301 (0.005)
Employment	162.700 (1.530)	-11.138 (0.398)
Seasonality	4.221E+04 (1.76E+04)	8018.167 (4043.610)
Recession	-2.886E+04 (6.49E+04)	7840.685 (1.59E+04)
Tornadoes	N = 135	N = 132
R-squared	0.965	0.542
Adj. R-squared	0.965	0.537

Significant Events (%) by Intensity



Significant Events (%) by County Size



Future Work

- Want model that can predict economic impact of tornado independent of geographic boundaries
- Could be a useful tool for:
  - Evaluating areas likely to experience an economic change
  - Aid in recovery
  - Efficiently allocate post-disaster relief funds

Summary

- Model captures larger percentage of stronger tornadoes, suggesting higher accuracy predicting changes in sales tax
- Model captures events almost exclusively in higher populated areas, suggesting higher accuracy when tornado impacts larger areas
- Tornadoes have a wide range of positive/negative impacts

References

- Donadelli, M., M. Juppner, A. Paradiso, and M. Ghislitti, 2020: Tornado activity, house prices, and stock returns. *The North American Journal of Economics and Finance*, **52**, https://doi.org/10.1016/j.najef.2020.101162